

3D radiative transfer code for polarized scattered light with aligned grains

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Polarized scattered light has been observed in cometary comae [1] and in circumstellar disks [2]. It carries information about the grains from which the light scattered. However, modelling polarized scattered light is a complicated problem. So far, most scattering codes consider either optically thin cases, where radiative transfer is not necessary, or only do one-dimensional (1D) radiative transfer. Three-dimensional (3D) radiative transfer is mainly focused on unpolarized radiation, which is easier to calculate.

We are working on a 3D Monte Carlo radiative transfer code, based on the unpolarized CRT code [3,4], which incorporates hierarchical grid structure (octree) and the full Stokes vector for both the incoming radiation and the radiation scattered by dust grains. The dust model will be able to include different populations of dust, differing in composition, size distribution, shapes, and orientation. The non-spherical dust grains can be randomly aligned, or a fraction of them can be aligned with the magnetic fields (in particular, by the radiation field via radiative torques). However, the inclusion of the non-spherical, aligned grains is a complicated and time consuming task. The final code will be a valuable tool in studying polarized scattered light from cometary comae in the solar system and from protoplanetary disks in the exoplanetary context.

We summarize the current state of the code, presenting comparison tests with the radiative-transfer coherent-backscattering code (RT-CB, [5]) and a simple model of a protoplanetary disk.

References

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